Space Weather Technical Forecast

Issued on Wednesday, 19 October 2022 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Fluence likely increasing, perhaps reaching Active (1e8 integrated pfu) from Day 3 onwards.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with a few low level C-class flares mostly originating from AR3124 which is now approaching the southwest limb of the visible disc. This is the largest and most complex group, although it remains a relatively small and magnetically straightforward region. There are currently four other regions on the visible disc, which are relatively small and simple regions, with little change. There remains numerous filaments on the facing side of the Sun at present, although none appear to have lifted off during this period. No Earth directed Coronal Mass Ejections (CMEs) were in evidence on available satellite imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, showed an ongoing but waning connection to the fast wind of CH32. The solar wind continued a slow decline from an elevated level of 550 km/s to a slightly elevated level of 490 km/s. The density was near average. The IMF, Bt, was weak at 6nT or below, with the north-south component, Bz, varying weakly between +6/-4 nT. The phi angle was mostly negative (towards the Sun) throughout. Geomagnetic activity was Quiet (Kp 0-2) throughout the period.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES16 was at mainly moderate levels, with a peak flux of 708 pfu recorded at 18/1645UTC. The associated fluence was below the Active (1e8 integrated pfu) threshold on a flat trend, with 3.3e7 integrated pfu observed at 19/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low or Very Low, barring any significant sunspot development on the visible disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the current forecast. Earth is currently in a waning high speed stream (HSS) related to CH32/-, with solar winds probably declining further to occasionally reach slow-ambient levels by Day 2 (20 Oct). The anticipated connection of second HSS related to CH33/+, is likely to maintain solar winds closer to slightly elevated levels from Day 3 (21 Oct). Geomagnetic activity is likely to continue Quiet with possible Unsettled or Active intervals, especially from Day 3 (21 Oct) as the HSS from CH33 arrives.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at background levels.
High energy electron flux (greater than 2MeV) as observed by GOES16 is likely to see an

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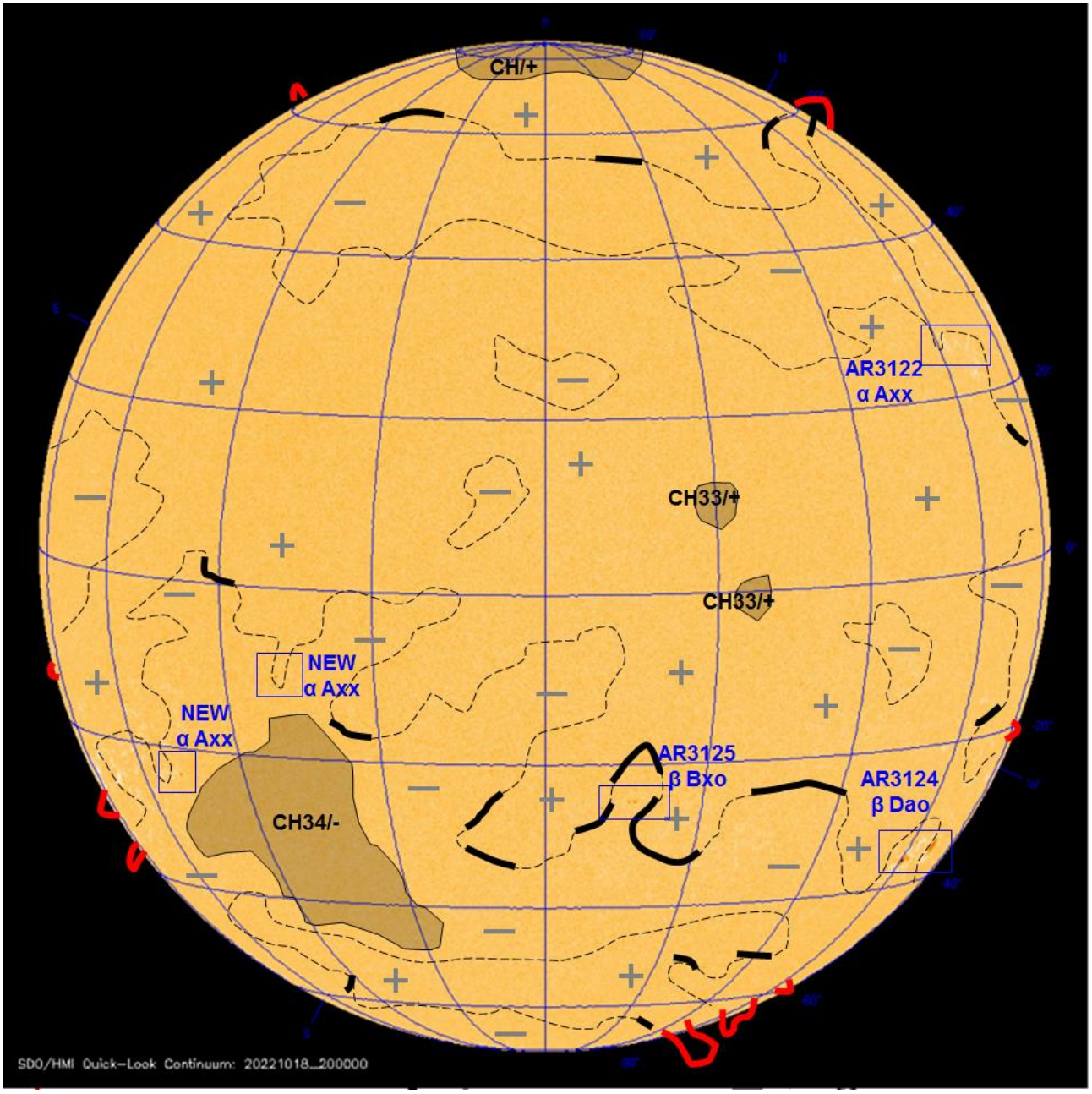
upward trend in coming days. Fluence levels will probably also be raised through this period, perhaps close to the Active (1e8 integrated pfu) threshold, although confidence in the magnitude of the peak fluence level is low.

Figure 1. Solar Analysis Valid 2000UTC, 18 October 2022.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

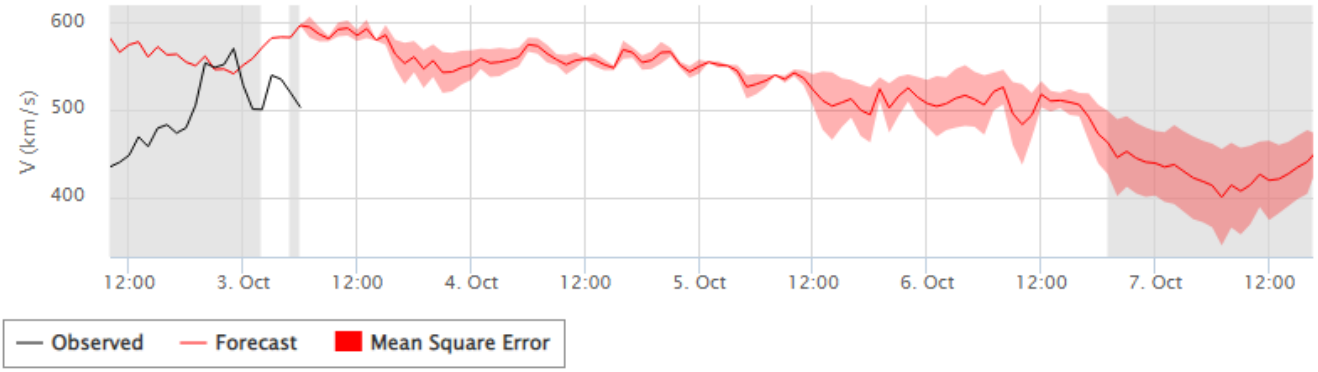
There are no Earth-directed CMEs in the current forecast. Earth is currently exiting the ongoing High Speed Stream (HSS) from CH32/- which is continuing to wane and solar winds are likely to be at slightly elevated levels during Day 1 (19 Oct), perhaps occasionally reaching slow-ambient levels by Day 2 (20 Oct). A second coronal hole feature, CH33/+, is progressing across the western hemisphere with two distinct holes in evidence. This feature is smaller and more fragmented than the previous rotation when solar winds reached around 500 km/s. Given that this feature has been closing up as it transits the visible disc, wind speeds may reach slightly elevated levels but are unlikely to go much higher. It is expected to arrive on Day 3 (21 Oct). Geomagnetic activity is expected to be Quiet with Unsettled or Active interval from Day 3 (21 Oct) as the HSS from CH33 connects to Earth.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Met Office Solar Winds Prediction Model (SWPM) indicating a decline in the next couple of days.



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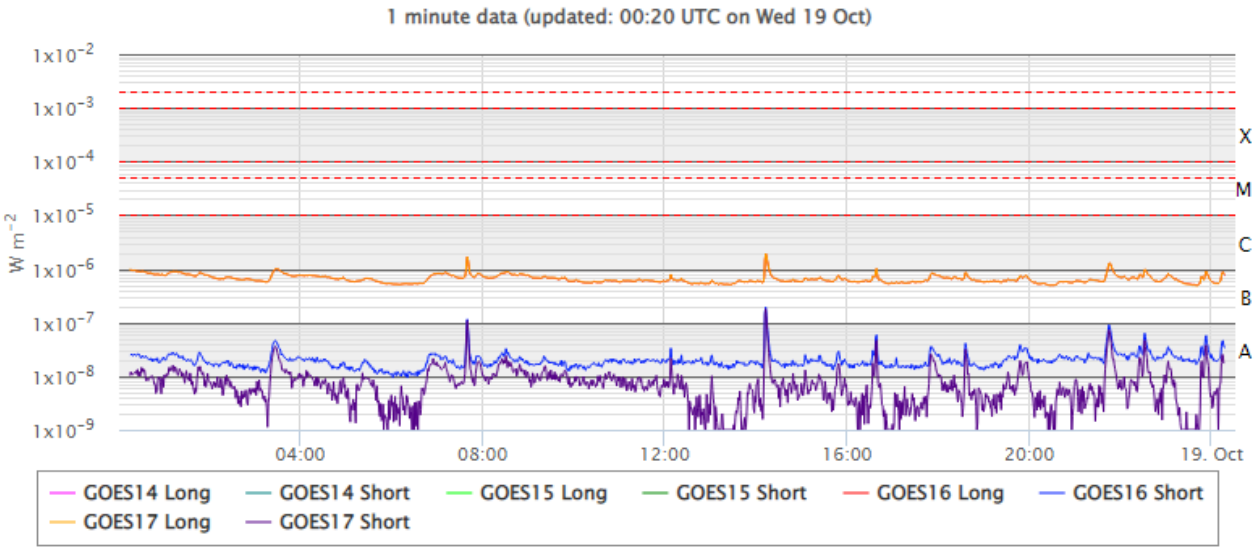
Radio Blackouts - X-Ray Flares:

Solar activity over the past 24 hours has been Low with several low level C-class flares, which are mostly attributed from the active region that is now approaching the southwest limb AR3124 (Dao/Beta)). This is the largest and most complex group, although it remains a relatively small and magnetically straightforward region. There are currently four other sunspot regions on the visible disc, none of which are showing much size or complexity. Located 50 degrees further east from the largest group is AR3125 (Bxo/Beta) which is a simple bipolar region and has shown further decay during the period. AR3122 is a unipolar simple region (Axx/Beta) nearing the northwestern limb and two simple regions which are unnumbered are currently located on the southeast quadrant.

Far-side soundings and STEREO-A EUVI 195 imagery hint at a possible returning sunspot region over the southeastern solar horizon, perhaps ex-3107. It is difficult to tell at this stage whether this region is likely to still be active, however. Overall, the presence of AR3124 will maintain a very slight chance of M-flares into Day 2 (20 Oct) before reducing as this region rotates off the disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-ray flux plot at GEO with several C-class flares in evidence.



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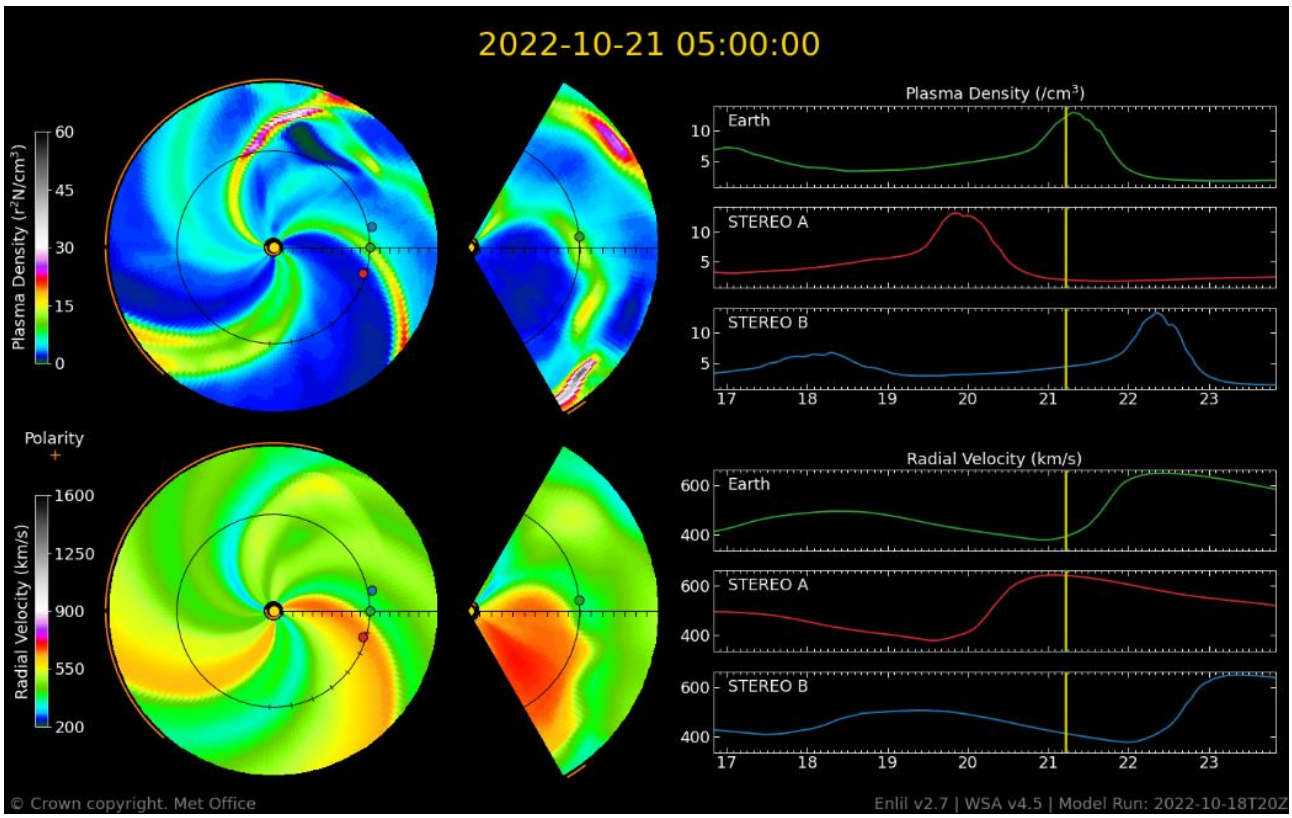
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at background levels and is expected to remain at this level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Met Office ENLIL showing the next HSS arrival time.



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High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) as observed by GOES16 peaked short of High (1000 pfu) levels in the past 24 hours. A further increase in the coming days is possible as the current HSS from CH32 wanes. A new HSS from CH33 is expected to arrive later in the period, although this is likely to be weak and may not have much effect on electron levels.
Fluence levels are expected to rise through this period, perhaps close to the Active (1e8 integrated pfu) threshold. MOSWOC REFM is suggesting a rise close to the Active threshold and this seems to be an over estimate although confidence in the magnitude of the peak fluence level is low.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	30	40	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: High energy electron flux at GEO over past three days and Met Office REFM output.

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